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quinlinethiol, 5-carbethoxy-2-thiouracil, 1 H-1,2,4-triazole-3-thiol, 1-phenyl-1 H-1,2,4-triazole-5-thiol, N,N'-ethylene thiourea, and 2-mercapto benzothiazole.

52. (Amended) The ~~method~~ as claimed in claim 51 wherein said leveler compound is selected from the group consisting of diethylenetriamine and thionicotinamide.

### REMARKS

#### A. 35 USC 102

Examiner has rejected claims 1-7, 9-10, 12-13, 21-24, 26-27, 29-30, 39-45, 47-48, 50-51 and 62-64 under 35 USC 102(b) as being anticipated by Yates et al. (US Patent 5,863,410).

Claims 9-10, 12, 26-27, 29, 47-48 and 50 have been canceled and their rejection is therefore moot.

Independent claims 1, 21 and 39 have been amended to recite an acid copper electroplating composition comprising, among others, a leveler compound containing single or multiply positively charged centers, and the leveler compound is "selected from the group consisting of polyethylenimine, 80% ethoxylated; poly(allylamine); poly(allylamine hydrochloride); polyaniline, sulfonated, 5 wt. % in water, 75 mole % sulfonated; poly[bis(2-chloroethyl)ether-alt-1,3-bis[3-(dimethylamino)propyl]urea, quaternized; poly[N,N'-bis(2,2,6,6-tetramethyl-4-piperidiny)-1,6-hexanediamine-co-2,4-dichloro-6-morpholino-1,3,5-triazine; polyacrylamide; poly(acrylamide-co-diallyldimethylammonium chloride); poly(diallyldimethylammonium chloride); poly(melamine-co-formaldehyde), partially methylated; poly(4-vinylpyridine), 25% cross-linked; and poly(1,2-dihydro-2,2,4-trimethylquinoline)."

Support for these listed compounds can be found on page 6 of the specification as filed, and no new matter has been added as a result of these amendments. Other dependent claims have been amended to provide consistency and proper antecedent basis with the amended independent claims.

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Although Yates teaches the use of polyethyleneamine polymer as an additive in an electrolyte for use in an electrolytic process for producing copper foils, Yates does not teach or disclose the use of leveler compounds recited in Applicants' amended claims 1, 21 and 39. Note that Applicants' polyethylenimine, 80% ethoxylated compound is not the same as the polyethylenimine polymer of Yates (non-ethoxylated). The ethoxylated polyethylenimine is a different compound, with different chemical structure, chemical property and leveling performance compared with Yates' polyethylenimine polymer.

Since Yates does not teach any of the leveler compounds in Applicants' amended claims 1, 21 and 39, these independent claims are not anticipated by Yates, and are therefore patentable under 35 U.S.C. 102(a).

Claims 13, 30 and 51 have been amended to be in independent form, and 2-thiohydantoin has been deleted from these claims. Yates does not teach any of the leveler compounds in the amended claims 13, 30 and 51. As such, these claims are not anticipated by Yates, and are patentable under 35 U.S.C. 102(a).

Dependent claims 2-7, 22-24, 38-45 and 62-64 depend, either directly or indirectly from claims 1, 21 and 39, and recite additional features therefor. For the same reasons set forth above, these claims are also not anticipated by Yates, and thus, patentable under 35 U.S.C. 102(a). Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. 102(a).

#### B. 35 USC 103

##### Claims 20, 38, 58-61 and 63-64

Claims 20, 38, 58-61 and 63-64 are rejected under 35 USC 103(a) as being unpatentable over Yates as applied to claim 39.

Although Yates teaches the presence of a polyamine polymer, and specifically, polyethylenimine, as an addition agent for electrodeposition of copper, Yates does not teach or suggest the use of leveler compounds recited in Applicants' amended claims 1, 21 and 39.

As previously discussed, the 80% ethoxylated polyethylenimine recited in Applicants' claims 1, 21 and 39 is different from the polyethylenimine polymer taught by Yates, with different chemical structure, chemical property and leveler performance. The operative effect

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and performance of a copper electroplating composition depend on the nature of specific organic additives. The fact that one chemical compound is effective as a leveler does not mean that a derivative can be an acceptable substitute. For example, the 80% ethoxylated polyethylenimine has a higher chemical stability and water solubility compared to Yates' non-ethoxylated compound. Furthermore, it is believed that the ability of the 80% ethoxylated compound to carry much more positive charges results in better performance as a leveler.

There is simply no teaching or suggestion by Yates that it is desirable to use a 80% ethoxylated polyethylenimine, or other leveler compounds recited in Applicants' claims 1, 21 and 39. Therefore, Applicants' amended claims 1, 21 and 39 are not obvious over the teaching of Yates. Claims 20, 38, 58-61 and 63-64, which depend directly or indirectly from claims 1, 21 and 39, are also not obvious, and thus patentable over Yates.

Claims 8, 11, 25, 28, 46 and 49

Claims 8, 11, 25, 28, 46 and 49 are rejected as being unpatentable over Yates as applied to claims 1, 21 and 39, and further in view of Luxon (US Patent 4,808,481).

Luxon's invention is directed to injection molding granules comprising copper coated fibers. Luxon teaches the use of several copper plating baths with various additives such as stabilizer, brightener, wetting agent, surfactant, etc. (e.g., col. 7, line 66 to col. 9, line 63.) However, Luxon simply does not teach or disclose the need or desirability of leveler compounds - e.g., those recited in Applicants' amended independent claims 1, 13, 21, 30, 39 and 51, for the purpose of producing copper-coated fibers. This is not surprising, since a leveler is typically used to ensure copper deposition with void-free and seam-free trench filling, which is not a problem or relevant to Luxon's coated fiber application.

Since neither Yates nor Luxon teach or suggest the leveler compounds recited in Applicants amended claims 1, 21, and 39, Applicants respectfully submit that these amended claims are not obvious over Yates and further in view of Luxon. Claims 8, 11, 25, 28, 46 and 49 depend, either directly or indirectly from claims 1, 21 and 39, and recited additional features therefor. For the same reasons set forth above, these claims are not obvious over Yates in view of Luxon, and are thus patentable under 35 U.S.C. 103(a).

Claims 14-17, 31-34, 37 and 52-55

Claims 14-17, 31-34, 37 and 52-55 are rejected as being unpatentable over Yates as applied to claims 1, 21 and 39, and further in view of Landau (US Patent 6,261,433).

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Landau is directed to an electro-chemical deposition system and method of electroplating. Although Landau discloses a list of levellers, brighteners and grain refiners (col. 18, line 62 to col. 19, line 45), Landau does not teach or suggest an acid copper electroplating composition containing a carrier compound, a water-soluble, mercapto-containing organic brightener compound and the leveler compounds recited in Applicants' amended claims 1, 21 and 39. Similar to Yates, Landau discloses polyethyleneimine (col. 19, line 32). However, there is no suggestion in Landau of the need or desirability for the 80% ethoxylated polyethyleneimine, which, as previously discussed, is not only structurally and chemically different from Applicants' 80% ethoxylated polyethyleneimine, but also provides better performance as a leveler. The lack of suggestion in Landau regarding alternative leveler compounds is consistent with Landau's invention being focused on the apparatus and method of electrodeposition, but not on the plating bath itself.

Claims 13, 30 and 51 have been amended to be in independent form, and 2-thiohydantoin has been deleted therefrom. As such, Landau does not teach or suggest an acid copper electroplating composition having a leveler compound recited in Applicants' amended claims 13-14, 30-31 and 51-52. Furthermore, contrary to Examiner's statement, Landau does not teach the use of diethylene triamine as a leveler. Instead, Landau discloses diethylene triamine penta acetic acid or salts and diethylenetriamine pentaacetate in the list of levellers, brighteners and grain refiners (see col. 18, line 62 to col. 19, line 46). These acetic acid or salts are different chemical compounds with structures and properties different from diethylenetriamine. As previously explained, the operative effect of electroplating composition depends on the particular compounds used in the formulation, and derivatives with different chemical properties cannot simply be regarded as obvious substitutes. As such, the amended claims 13, 30 and 51 are not obvious over Yates in view of Landau.

Dependent claims 14-17, 31-34, 37 and 52-55 depend either directly or indirectly from claims 1, 13, 21, 30, 39 and 51, and recite additional features therefor. For the same reasons set forth above, these claims are also not obvious over Yates in view of Landau, and thus, patentable under 35 U.S.C. 103(a).

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Claims 18-19, 35-36 and 56-57

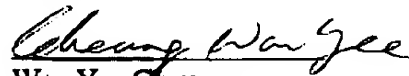
Claims 18-19, 35-36 and 56-57 are rejected as being unpatentable over Yates as applied to claims 1, 21 and 39 and further in view of Dubois et al. (US Patent 5,147,905).

Dubois et al. teaches advanced and unadvanced epoxy resin compositions or nucleophilic derivatives thereof, as well as curable compositions and coating compositions containing same. However, Dubois et al. does not teach or suggest an acid copper electroplating composition containing a carrier compound, a water-soluble, mercapto-containing organic brightener and a leveler compound recited in Applicants' amended claims 1, 21 and 39. As such, the amended claims 1, 21 and 39 are not obvious over Dubois et al.

Furthermore, there is no suggestion or motivation in Yates to combine the electrolytic process of producing copper foil with the resin compositions in Dubois et al., and even if Yates were to be combined with Dubois et al., one would not have arrived at Applicants' amended claims 1, 21 and 39. Therefore, Applicants submit that independent claims 1, 21 and 39 are not obvious, and thus patentable over Yates in view of Dubois et al. Since claims 18-19, 35-36 and 56-57 depend, either directly or indirectly from claims 1, 21 and 39, these claims are also not obvious over Yates in view of Dubois et al., and thus, patentable under 35 U.S.C. 103(a).

In view of the remarks set forth above, Applicants request reconsideration of the rejection and allowance of all presently pending claims - namely, claims 1-8, 11, 13-14, 16-25, 28, 30-31, 33-46, 49, 51-52 and 54-64. Since the claims are in condition for allowance, prompt and favorable action is hereby respectfully solicited. Should there be any remaining issues, please feel free to call the Applicant's attorney in order to expedite the resolution of these issues.

Respectfully submitted,



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Enclosures:

Transmittal Form

Petition for Extension of Time

Petition to Revive Unintentionally Abandoned Application

Fee Transmittal

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## VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the claims

Claims 9-10, 12, 15, 26-27, 29, 32, 47-48, 50 and 53 have been cancelled.

Claims 1, 6, 11, 13-14, 21, 23, 28, 30, 31, 39, 49 and 51-52 have been amended as follows:

1. (Amended) An acid copper electroplating composition comprising an aqueous solution of an acid and a copper salt, the improvement comprising the addition of at least one of a carrier compound; a water-soluble, mercapto-containing organic brightener compound; and a leveler compound which comprises an organic compound containing single [and/or] multiply positively charged centers; wherein said organic compound is selected from the group consisting of polyethylenimine, 80% ethoxylated; poly(allylamine); poly(allylamine hydrochloride); polyaniline, sulfonated, 5 wt. % in water, 75 mole % sulfonated; poly[bis(2-chloroethyl)ether-alt-1,3-bis[3-(dimethylamino)propyl]urea, quaternized; poly[N,N'-bis(2,2,6,6-tetramethyl-4-piperidinyl)-1,6-hexanediamine-co-2,4-dichloro-6-morpholino-1,3,5-triazine; polyacrylamide; poly(acrylamide-co-diallyldimethylammonium chloride); poly(diallyldimethylammonium chloride); poly(melamine-co-formaldehyde), partially methylated; poly(4-vinylpyridine), 25% cross-linked; and poly(1,2-dihydro-2,2,4-trimethylquinoline).

6. (Amended) The composition as claimed in claim 1/5 wherein said polysaccharide carrier is selected from the group consisting of starch, cellulose, amylopectin and amylose.

11. (Amended) The composition as claimed in claim [10]1 wherein said [polymeric leveler]organic compound is selected from the group consisting of poly[(bis(2-chloroethyl)ether-alt-1,2-bis[3-(dimethylamino)propyl]urea, quaternized, and poly(diallyldimethylammonium chloride).

13. (Amended) [The composition as claimed in claim 12 wherein said low molecular weight leveler is ]An acid copper electroplating composition comprising an aqueous solution of an acid and a copper salt, the improvement comprising the addition of at least one of a carrier compound; a water-soluble, mercapto-containing organic brightener compound; and a leveler compound selected from the group consisting of 2,5-dithiobiurea, dithiooxamide, 1-phenyl-2-thiourea, diethylenetriamine, *p*-xylenebis(tetrahydrothiophenium) chloride, [2-thiohydantoin.]

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pseudo thiohydantoin, (R)-(-)-thiazolidine-4-carboxylic acid, 3-(2'-thiopyridinium) propyl sulfonate, 2,2'-dipyridyl disulfide, 4,4'-dipyridyl disulfide, thionicotinamide, 4-(trifluoromethyl)-2-pyrimidinethiol, 2-mercapto-4-methylpyrimidine hydrochloride, 5-phenyl-1 *H*-1,2,4-triazole-3-thiol, 5-(4'-pyridyl)-1 *H*-1,2,4-triazole-3-thiol, 2-amino-6-purinethiol, 4-amino-5-(4'-pyridyl)-4 *H*-1,2,4-triazole-3-thiol, diethyl heptadecyl imidazolinium ethylsulfate, hexamethylenetetraamine, 1,3-bis(3-pyridylmethyl)-2-thiourea, 2,4-diamino-6-mercaptopyrimidine hemisulfate, dithiouracil, 4,5-diamino-2,6-dimercaptopyrimidine, 4,5-diamino-6-hydroxy-2-mercaptopyrimidine hemisulfate hydrate, 4(5)-imidazoledithio-carboxylic acid, 2-mercapto-5-benzimidazolesulfonic acid, sodium salt dihydrate, 2-thiouracil, trithio cyanuric acid, (2-pyrimidylthio) acetic acid, 7-trifluoromethyl-4-quinlinethiol, 5-carbethoxy-2-thiouracil, 1 *H*-1,2,4-triazole-3-thiol, 1-phenyl-1 *H*-1,2,4-triazole-5-thiol, *N,N'*-ethylene thiourea, and 2-mercapto benzothiazole.

14. (Amended) The composition as claimed in claim 13 wherein said *[low molecular weight]* leveler **compound** is selected from the group consisting of diethylenetriamine and thionicotinamide.

21. (Amended) An improved method for making an acid copper electroplating bath comprising an aqueous solution of acid and copper salt, the improvement comprising adding to said bath a carrier compound; a water-soluble, mercapto-containing organic brightener compound; and a leveler compound which comprises an organic compound containing single *[and/or]* multiply *positively* charged centers; wherein said organic compound is selected from the group consisting of polyethylenimine, 80% ethoxylated; poly (allylamine); poly (allylamine hydrochloride); polyaniline, sulfonated, 5 wt. % in water, 75 mole % sulfonated; poly(bis (2-chloroethyl)ether-alt-1,3-bis[3-(dimethylamino)propyl]urea, quaternized; poly[N,N'-bis(2,2,6,6-tetramethyl-4-piperidiny)]-1,6-hexanediamine-co-2,4-dichloro-6-morpholino-1,3,5-triazine; polyacrylamide; poly(acrylamide-co-diallyldimethylammonium chloride); poly(diallyldimethylammonium chloride); poly(melamine-co-formaldehyde), partially methylated; poly(4-vinylpyridine), 25% cross-linked; and poly(1,2-dihydro-2,2,4-trimethylquinoline).

23. (Amended) The method as claimed in claim *[21/22]* wherein said polysaccharide carrier is selected from the group consisting of starch, cellulose, amylopectin and amylose.

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28. (Amended) The method as claimed in claim [26]21 wherein said [polymeric leveler]organic compound is selected from the group consisting of poly[(bis (2-chloroethyl)ether-alt-1,3-bis [3-(dimethylamino)propyl]urea, quaternized, and poly (diallyldimethylammonium chloride).

30. (Amended) [The method as claimed in claim 26 wherein said low molecular weight leveler is]An improved method for making an acid copper electroplating bath comprising an aqueous solution of acid and copper salt, the improvement comprising adding to said bath a carrier compound; a water-soluble, mercapto-containing organic brightener compound; and a leveler compound selected from the group consisting of 2,5-dithiobiurea, dithiooxamide, 1-phenyl-2-thiourea, and diethylenetriamine, p-xylenebis(tetrahydrothiophenium) chloride, [2-thiohydantoin,] pseudo thiohydantoin, (R)-(-)-thiazolidine-4-carboxylic acid, 3-(2'-thiopyridinium) propyl sulfonate, 2,2'-dipyridyl disulfide, 4,4'-dipyridyl disulfide, thionicotinamide, 4-(trifluoromethyl) -2-pyrimidinethiol, 2-mercapto-4-methylpyrimidine hydrochloride, 5-phenyl-1 H-1,2,4-triazole-3-thiol, 5-(4'-pyridyl)-1 H -1,2,4-triazole-3-thiol, 2-amino-6 purinethiol, 4-amino-5-(4'-pyridyl)-4 H-1,2,4-triazole-3-thiol, diethyl heptadecyl imidazolinium ethylsulfate, hexamethylenetetraamine, 1,3-bis(3-pyridylmethyl)-2-thiourea, 2,4-diamino-6 mercaptopyrimidine hemisulfate, dithiouracil, 4,5-diamino-2,6-dimercaptopyrimidine, 4,5-diamino-6-hydroxy-2-mercaptopyrimidine hemisulfate hydrate, 4(5)-imidazoledithio-carboxylic acid, 2-mercapto-5-benzimidazolesulfonic acid, sodium salt dihydrate, 2-thiouracil, trithio cyanuric acid, (2-pyrimidylthio) acetic acid, 7-trifluoromethyl-4-quinlinethiol, 5-carbethoxy-2-thiouracil, 1 H-1,2,4-triazole-3-thiol, 1-phenyl-1 H-1,2,4-triazole-5-thiol, N,N'-ethylene thiourea, and 2-mercapto benzothiazole.

31. (Amended) The method as claimed in claim 30 wherein said [low molecular weight leveler]organic compound is selected from the group consisting of diethylenetriamine and thionicotinamide.

39. (Amended) A method for copper plating of advanced interconnects comprising immersing said interconnects in a copper plating bath comprising an aqueous solution of an acid and a copper salt and at least one of a carrier compound; a water-soluble, mercapto-containing organic brightener compound; and a leveler compound containing single [and]or multiply positively charged centers; wherein said leveler compound is selected from the group consisting of polyethylenimine, 80% ethoxylated; poly(allylamine); poly(allylamine hydrochloride); polyaniline, sulfonated, 5 wt. % in water, 75 mole % sulfonated; poly[bis(2-chloroethyl)ether-alt-1,3-bis[3-(dimethylamino)propyl]urea, quaternized; poly[N,N'-bis(2,2,6,6-tetramethyl-4-piperidinyl)-1,6-hexanediamine-co-2,4-dichloro-6-morpholino-1,3,5-triazine; polyacrylamide; poly(acrylamide-co-diallyldimethylammonium chloride); poly(diallyldimethylammonium



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chloride); poly(melamine-co-formaldehyde), partially methylated; poly(4-vinylpyridine), 25% cross-linked; and poly(1,2-dihydro-2,2,4-trimethylquinoline).

49. (Amended) The method as claimed in claim 47 wherein said [polymeric] leveler compound is selected from the group consisting of poly[(bis(2-chloroethyl)ether-alt-1,2-bis[3-(dimethylamino)propyl]urea, quaternized, and poly(diallyl dimethylammonium chloride).

51. (Amended) [The method as claimed in claim 50 wherein said low molecular weight leveler is]A method for copper plating of advanced interconnects comprising immersing said interconnects in a copper plating bath comprising an aqueous solution of an acid and a copper salt and at least one of a carrier compound; a water-soluble, mercapto-containing organic brightener compound; and a leveler compound selected from the group consisting of 2,5-dithiobiurea, dithiooxamide, 1-phenyl-2-thiourea, diethylenetriamine, p-xylenebis(tetrahydrothiophenium) chloride, [2-thiohydantoin,] pseudo thiohydantoin, (R)-(-)-thiazolidine-4-carboxylic acid, 3-(2'-thiopyridinium) propyl sulfonate, 2,2'-dipyridyl disulfide, 4,4'-dipyridyl disulfide, thionicotinamide, 4-(trifluoromethyl)-2-pyrimidinethiol, 2-mercapto-4-methylpyrimidine hydrochloride, 5-phenyl-1 H-1,2,4-triazole-3-thiol, 5-(4'-pyridyl)-1 H-1,2,4-triazole-3-thiol, 2-amino-6-purinethiol, 4-amino-5-(4'-pyridyl)-4 H-1,2,4-triazole-3-thiol, diethyl heptadecyl imidazolinium ethylsulfate, hexamethylenetetraamine, 1,3-bis(3-pyridylmethyl)-2-thiourea, 2,4-diamino-6-mercaptopyrimidine hemisulfate, dithiouracil, 4,5-diamino-2,6-dimercaptopyrimidine, 4,5-diamino-6-hydroxy-2-mercaptopyrimidine hemisulfate hydrate, 4(5)-imidazoledithio-carboxylic acid, 2-mercapto-5-benzimidazolesulfonic acid, sodium salt dihydrate, 2-thiouracil, trithio cyanuric acid, (2-pyrimidylthio) acetic acid, 7-trifluoromethyl-4-quinlinethiol, 5-carbethoxy-2-thiouracil, 1 H-1,2,4-triazole-3-thiol, 1-phenyl-1 H-1,2,4-triazole-5-thiol, N,N'-ethylene thiourea, and 2-mercapto benzothiazole.

52. (Amended) The method as claimed in claim 51 wherein said [low molecular weight] leveler compound is selected from the group consisting of diethylenetriamine and thionicotinamide.